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EXAMINER

FEELY, MICHAEL J

ART UNIT	PAPER NUMBER
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1712

DATE MAILED: 12/28/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/006,419

Applicant(s)

OTTINGER ET AL.

Examiner

Michael J. Feely

Art Unit

1712

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 October 2005.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-16, 18-30 and 36-65 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-16, 18-30 and 36-65 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____.
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____.

DETAILED ACTION

Pending Claims

Claims 1-16, 18-30, and 36-65 are pending.

Response to Amendment

1. The declaration filed on October 3, 2005 under 37 CFR 1.131 has been considered but is ineffective to overcome the supporting reference of Mercuri (US Pat. No. 6,517,964).

Applicant has provided numerous appendices in order to swear behind the effective date of Mercuri; however, Appendix 1a (*described as a product catalogue for SIGRAFLEX® products*) was not included in the submission of October 3, 2005. This appendix is critical because it was meant to show characteristics of the carbon “primary product” of the instant invention, including ash value. Without this information, it is unclear if Applicants reduced the instant invention to practice commensurate in the scope of the instant claims. Specifically, there is no evidence of the claimed ash value (*claims 1, 14 & 18*) or incorporation of fillers (*claims 10 & 30*) in the “primary product”.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. The rejection of claims 1-16, 18-30, and 36-65 under 35 U.S.C. 103(a) as being unpatentable over Woods (US Pat. No. 6,656,580 or WO 01/43964), Technical Data Sheets for

Art Unit: 1712

Resinol 90C and Resinol RTC, (*provided by Loctite*), and Mercuri (US Pat. No. 6,517,964) stands for the reasons of record.

In the following rejection, the technical data sheets have been used to show inherent characteristics of the acrylic resin used in Woods. In addition, since the Woods references are equivalents, all citations are directed towards the US patent.

Regarding claims 1-6, 10, 13, 36-40, 46-48, and 62-65, Woods (*with support of the Technical Data Sheets*) discloses, **(1 & 10)** a synthetic resin-impregnated body (column 4, lines 40-47) comprising a primary product formed of expanded or at least partially recompressed expanded graphite having a liquid-accessible pore system (column 4, line 50 through column 5, line 5), wherein said primary product is impregnated (column 5, lines 20-35) with at least one of: at least one solvent-free polymerizable acrylic resin system; and polymers obtained by curing said at least one resin system (column 5, lines 5-10; Technical Data Sheets for Resinol 90C and Resinol RTC);

(2 & 36) wherein said at least one acrylic resin system contains triethyleneglycol dimethacrylate (column 9, lines 45-56) and at least one initiator system (column 10, lines 13-27); **(3 & 37)** wherein said at least one acrylic resin system contains azo initiators as said at least one initiator (column 10, lines 49-67); **(4 & 38)** wherein said azo initiators contained in at least one acrylic resins systems are selected from the group consisting of 2,2'-dimethyl-2,2'-asodipropionitrile, 1,1'-azobis(1-cyclohexanecarbonitrile) and azoisobutyric acid nitrile (column 10, lines 49-67);

Art Unit: 1712

(5 & 39) wherein said at least one acrylic resin system has a storage stability at room temperature of more than two days (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(6 & 40) herein said at least one acrylic resin system has a storage stability at room temperature of more than two weeks (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(13 & 46) wherein a continuous resin surface film is not present and the body is electrically conductive (column 6, lines 50-59; column 4, lines 11-16);

(47 & 48) a heat conducting element comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50);

(62 & 63) a sealing element comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50); and

(64 & 65) a fuel cell component comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50).

Regarding claims 14-16, 18, 22-24, 30, 49, 50, and 54-56, Woods (with support of the Technical Data Sheet s) discloses (14, 18 & 30) a process for producing a resin-impregnated body (column 5, lines 20-36), which comprises: providing a primary product formed of expanded or at least partially recompressed expanded graphite having a liquid-accessible pore system (column 4, line 50 through column 5, line 5); impregnating the primary product with at least one solvent-free polymerizable acrylic resin system to form a resin-containing, uncured intermediate product (column 5, lines 5-10; Technical Data Sheets for Resinol 90C and Resinol

Art Unit: 1712

RTC); and finally subjecting the intermediate product to a curing treatment (column 10, lines 36-49);

(15 & 49) which further comprises processing the resin-containing, uncured intermediate product to form a shaped body (column 5, lines 30-36); and carrying out the subjecting step by subjecting the uncured shaped body produced from the uncured intermediate product to a curing treatment for the at least one resin system (column 10, lines 36-49); (16 & 50) which further comprises simultaneously shaping the acrylic resin-containing body (column 5, lines 30-55) and curing the resin system that is present as a result of temperature impact (column 10, lines 36-49);

(22 & 54) wherein the acrylic resin has a viscosity at room temperature of less than 100 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(23 & 55) wherein the acrylic resin has a viscosity at room temperature of less than 50 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C); and

(24 & 56) wherein the acrylic resin has a viscosity at room temperature of less than 20 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C).

With respect to all of the above mentioned claims, Woods uses his impregnated flexible graphite sheet (*from compressed, exfoliated graphite particles*) to form sealed fluid-flow field plates in a fuel cell (*see 222A and 222C of Figure 3*). These impregnated flexible graphite plates are very similar to impregnated bodies of the instant invention; however, Woods is deficient because he fails to disclose the following limitations:

- (1 & 14) wherein the primary product has an ash value limited to not more than four percent of the primary product;

Art Unit: 1712

- (18) wherein the primary product has an ash value limited to not more than two percent of the primary product; and
- (10 & 30) wherein the primary product contains fillers selected from the group consisting of ceramic fillers, mineral fillers, electrically non-conductive fillers, and electrically conductive fillers.

Mercuri also discloses flexible graphite sheets used in the formation of fuel cells.

Mercuri focuses on electrodes (*see 110 of Figures 2, 3, and 3A*), as opposed to the fluid-flow field plates (*see 1000 and 1100 of Figures 2, 3, and 3A*), wherein, “The flexible graphite can also, at times, be advantageously treated with resin and the absorbed resin, after curing, enhances the moisture resistance and handling strength, i.e. stiffness, of the flexible graphite sheet.

Suitable resin content is preferably about 20 to 30% by weight, suitably up to about 60% by weight,” (*see column 7, lines 27-32*).

With respect to the ash value limitation, Mercuri discloses that ash value is an indicator of graphite purity, wherein, “Generally, any carbon-containing material, the crystal structure of which possesses the required degree of graphitization and which can be chemically treated and exfoliated, is suitable for use with the present invention. Such graphite preferably has an ash content of less than six weight percent. More preferably, the graphite employed for the present invention will have a purity of at least about 99%. In the most preferred embodiment, the graphite employed will have a purity of at least about 99.9%,” (*see column 4, lines 51-59*). This ash content appears to be suitable for fuel cell construction in general, including the fluid-flow field plates taught by Woods.

Art Unit: 1712

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to limit the ash value of flexible graphite sheets to values of less than four percent and less than two percent, as taught by Mercuri, in the fluid-flow field plates of Woods because Mercuri discloses the use of flexible graphite sheets in fuel cell construction, wherein the ash content is preferably less than one percent to maintain an acceptable level of graphite purity.

With respect to the incorporation of fillers, Mercuri discloses, “Flexible graphite sheet material is coherent, with good handling strength, and is suitably compressed, e.g. by roll-pressing, to a thickness of about 0.075 mm to 3.75 mm and a typical density of about 0.08 to 2.0 grams per cubic centimeter (g/cc). From about 1.5-30% by weight of ceramic additives can be blended with the intercalated graphite flakes as described in US Pat. No. 5,902,762 (which is incorporated here to provide enhanced resin impregnation in the final flexible graphite product),” (see column 7, lines 7-15). The incorporation of these ceramic fillers appears to be suitable for fuel cell construction in general, including the fluid-flow field plates taught by Woods.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate ceramic fillers in flexible graphite sheets, as taught by Mercuri, in the fluid-flow field plates of Woods because Mercuri discloses the use of flexible graphite sheets in fuel cell construction, wherein the ceramic fillers are blended with the intercalated graphite flakes to provide enhanced resin impregnation in the final flexible graphite product.

** In the above rejections, the impregnated carbon body would have been inherently thermally and electrically conductive due to the inherent conductive nature of the graphite material. In*

Art Unit: 1712

addition, the acrylic resins would have been inherently “solvent-free” because the Technical Data Sheets provide no detail regarding a solvent presence or content.

Regarding claims 7-9, 25-27, 41-43, and 57-59, Woods is silent regarding providing specific “take-up” values of (7, 25, 41 & 57) up to 100% (up to 50 wt% acrylic), (8, 26, 42 & 58) 5-35% (5 to 25 wt% acrylic), and (9, 27, 43 & 59) 10-25% (10 to 20 wt% acrylic). However, he discloses, “the amount of sealant up-take can be controlled over a wide range by varying the impregnation pressure, temperature, sealant viscosity, impregnation time or density of the sheet,” (column 6, lines 33-36). Applicant fails to show criticality for this range, and this range is a result effective because it has a direct impact on the process-ability and shaping capability of the impregnated sheet. In light of Woods’ teaching, it would have been obvious to one skilled in the art to tailor the “up-take” value by choosing the appropriate processing and material parameters.

Furthermore, it has been found that, “where general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation,” –*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the specific “take-up” values of up to 100% (up to 50 wt% acrylic), 5-35% (5 to 25 wt% acrylic), and 10-25% (10 to 20 wt% acrylic) in the impregnated body of Woods because Woods discloses that the “take up” can be tailored by numerous process and material parameters, resulting in desirable process-ability and shaping capability of the impregnated body.

Regarding claims 28, 29, 60, and 61, Woods fails to explicitly disclose the curing conditions set forth in claims (28, 29, 60 & 61). However, Applicant fails to show criticality for

Art Unit: 1712

these curing conditions, and these conditions are result effective variables, necessary to achieve a successful curing reaction.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the curing conditions of less than 10 minutes or less than 3 minutes at a temperature of up to 200°C in order to achieve an optimized and successful curing reaction of the impregnated resin.

Regarding claims 19-21 and 51-53, Woods does not explicitly disclose the process of claim 14 or 30, wherein **(19 & 51)** the primary product *maintains* a bulk density in a range of from 0.1 to 1.8 g/cm³ (*see column 4, lines 57-61; *column 5, lines 36-44**); wherein **(20 & 52)** the primary product *maintains* a bulk density in a range of from 0.3 to 1.5 g/cm³ (*see column 4, lines 57-61; *column 5, lines 36-44**); and wherein **(21 & 53)** the primary product *maintains* a bulk density in a range of from 0.5 to 1.3 g/cm³ (*see column 4, lines 57-61; *column 5, lines 36-44**).

Rather, Woods discloses, “For example, a graphite sheet with a graphite density of about 0.08 to about 0.5 g/cc may be mechanically deformed resulting in a compressed sheet or plate with a graphite density greater than 1.0 g/cc,” (column 5, lines 36-44). Woods does not provide any examples satisfying this limitation; however, the claimed ranges overlap the open-ended range set forth in Woods.

In light of this, it has been found that in the case where claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists – *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

Art Unit: 1712

Therefore, the maintained density ranges of claims 19-21 would have been obvious because the initial range of Woods, 0.08 to about 0.5 g/cc, falls within the claimed range, and the final range of Woods, greater than 1.0 g/cc, overlaps the claimed range.

Regarding claims 11 and 44, Woods discloses the synthetic resin-impregnated body according to claim 1 or 10, wherein (11 & 44) it includes at least two independently held together networks, one of said networks being formed of a connected framework made of expanded or expanded and thereafter at least partially recompressed graphite with electrical and thermal conductivity, and the other of said networks being a connected network made of synthetic material having penetrated into said pore system (column 4, line 50 through column 5, line 5; column 5, lines 20-35); however, he does not explicitly disclose an electrical volume resistance from 0.10 to 0.77 mΩ.

Due to the conductive nature of the graphite materials, it appears that this volume resistance would have been an inherent property of Woods' invention. The resin-impregnated body of Woods contains the same materials as the instant invention.

In light of this, it has been found that, "Products of identical chemical composition can not have mutually exclusive properties." A chemical composition and its properties are inseparable. Therefore if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present – *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

Therefore the product of Woods would have inherently had a volume resistance of from 0.10 to 0.77 mΩ because the materials used are the same as those used in the instant invention.

Regarding claims 12 and 45, Woods discloses the synthetic resin-impregnated body according claim 1 or 10, *(12 & 45)* including a surface, regions close to said surface, and a remaining part (column 6, lines 12-22 and 50-59); however, he does not explicitly disclose that the resin system is disposed only in one of said remaining part and said regions.

The impregnation method of the instant invention is indistinguishable from the impregnation method used by Woods. In addition, Wood provides an optional step of removing excess resin (column 6, lines 50-59), which would have inherently removed resin from the surface and those areas *close to the surface*.

Therefore, the limitation of claims 12 and 45 would have been inherently satisfied by Woods because his impregnation step is accompanied by the removal of excess liquid, which inherently removes resin from the surface and those areas close to the surface.

4. Claims 10, 36-47, 49-62, and 64 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woods (US Pat. No. 6,656,580 or WO 01/43964), Technical Data Sheets for Resinol 90C and Resinol RTC, *(provided by Loctite)*, and Mercuri et al. (US Pat. No. 5,902,762).

In the following rejection, the technical data sheets have been used to show inherent characteristics of the acrylic resin used in Woods. In addition, since the Woods references are equivalents, all citations are directed towards the US patent.

Regarding claims 10, 36-40, 46-47, 62 and 64, Woods *(with support of the Technical Data Sheets)* discloses, *(10)* a synthetic resin-impregnated body (column 4, lines 40-47) comprising a primary product formed of expanded or at least partially recompressed expanded graphite having a liquid-accessible pore system (column 4, line 50 through column 5, line 5),

Art Unit: 1712

wherein said primary product is impregnated (column 5, lines 20-35) with at least one of: at least one solvent-free polymerizable acrylic resin system; and polymers obtained by curing said at least one resin system (column 5, lines 5-10; Technical Data Sheets for Resinol 90C and Resinol RTC);

(36) wherein said at least one acrylic resin system contains triethyleneglycol dimethacrylate (column 9, lines 45-56) and at least one initiator system (column 10, lines 13-27);

(37) wherein said at least one acrylic resin system contains azo initiators as said at least one initiator (column 10, lines 49-67); (38) wherein said azo initiators contained in at least one acrylic resins systems are selected from the group consisting of 2,2'-dimethyl-2,2'-asodipropiononitrile, 1,1'-azobis(1-cyclohexanecarbonitrile) and azoisobutyric acid nitrile (column 10, lines 49-67);

(39) wherein said at least one acrylic resin system has a storage stability at room temperature of more than two days (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(40) herein said at least one acrylic resin system has a storage stability at room temperature of more than two weeks (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(46) wherein a continuous resin surface film is not present and the body is electrically conductive (column 6, lines 50-59; column 4, lines 11-16);

(47) a heat conducting element comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50);

Art Unit: 1712

(62) a sealing element comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50); and

(64) a fuel cell component comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50).

Regarding claims 30, 49, 50, and 54-56. Woods (with support of the Technical Data Sheet s) discloses (30) a process for producing a resin-impregnated body (column 5, lines 20-36), which comprises: providing a primary product formed of expanded or at least partially recompressed expanded graphite having a liquid-accessible pore system (column 4, line 50 through column 5, line 5); impregnating the primary product with at least one solvent-free polymerizable acrylic resin system to form a resin-containing, uncured intermediate product (column 5, lines 5-10; Technical Data Sheets for Resinol 90C and Resinol RTC); and finally subjecting the intermediate product to a curing treatment (column 10, lines 36-49);

(49) which further comprises processing the resin-containing, uncured intermediate product to form a shaped body (column 5, lines 30-36); and carrying out the subjecting step by subjecting the uncured shaped body produced from the uncured intermediate product to a curing treatment for the at least one resin system (column 10, lines 36-49); (50) which further comprises simultaneously shaping the acrylic resin-containing body (column 5, lines 30-55) and curing the resin system that is present as a result of temperature impact (column 10, lines 36-49);

(54) wherein the acrylic resin has a viscosity at room temperature of less than 100 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(55) wherein the acrylic resin has a viscosity at room temperature of less than 50 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C); and

(56) wherein the acrylic resin has a viscosity at room temperature of less than 20 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C).

With respect to all of the above mentioned claims, Woods uses his impregnated flexible graphite sheet (*from compressed, exfoliated graphite particles*) to form sealed fluid-flow field plates in a fuel cell (*see 222A and 222C of Figure 3*). These impregnated flexible graphite plates are very similar to impregnated bodies of the instant invention; however, Woods is deficient because he fails to disclose the following limitation:

- (10 & 30) wherein the primary product contains fillers selected from the group consisting of ceramic fillers, mineral fillers, electrically non-conductive fillers, and electrically conductive fillers.

With respect to the incorporation of fillers, Mercuri et al. disclose flexible graphite materials that are analogous to those used in Woods (*see column 1, lines 4-23*). Further, they disclose that embedding ceramic fibers in a flexible graphite sheet results in ceramic fibers extending from the sheet's surfaces into the sheet, increasing the permeability of the sheet to resin (*Abstract; column 1, lines 4-23*).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to embed ceramic fillers, as taught by Mercuri et al., in the flexible graphite sheets (*fluid-flow field plates*) of Woods because Mercuri et al. disclose that embedding ceramic fibers in a flexible graphite sheet results in ceramic fibers extending from the sheet's surfaces into the sheet, increasing the permeability of the sheet to resin.

Art Unit: 1712

** In the above rejections, the impregnated carbon body would have been inherently thermally and electrically conductive due to the inherent conductive nature of the graphite material. In addition, the acrylic resins would have been inherently "solvent-free" because the Technical Data Sheets provide no detail regarding a solvent presence or content.*

Regarding claims 41-43 and 57-59, Woods is silent regarding providing specific "take-up" values of (41 & 57) up to 100% (up to 50 wt% acrylic), (42 & 58) 5-35% (5 to 25 wt% acrylic), and (43 & 59) 10-25% (10 to 20 wt% acrylic). However, he discloses, "the amount of sealant up-take can be controlled over a wide range by varying the impregnation pressure, temperature, sealant viscosity, impregnation time of density of the sheet," (column 6, lines 33-36). Applicant fails to show criticality for this range, and this range is a result effective because it has a direct impact on the process-ability and shaping capability of the impregnated sheet. In light of Woods' teaching, it would have been obvious to one skilled in the art to tailor the "up-take" value by choosing the appropriate processing and material parameters.

Furthermore, it has been found that, "where general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation," *-In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the specific "take-up" values of up to 100% (up to 50 wt% acrylic), 5-35% (5 to 25 wt% acrylic), and 10-25% (10 to 20 wt% acrylic) in the impregnated body of Woods because Woods discloses that the "take up" can be tailored by numerous process and material parameters, resulting in desirable process-ability and shaping capability of the impregnated body.

Regarding claims 60, and 61, Woods fails to explicitly disclose the curing conditions set forth in claims (60 & 61). However, Applicant fails to show criticality for these curing conditions, and these conditions are result effective variables, necessary to achieve a successful curing reaction.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the curing conditions of less than 10 minutes or less than 3 minutes at a temperature of up to 200°C in order to achieve an optimized and successful curing reaction of the impregnated resin.

Regarding claims 51-53, Woods does not explicitly disclose the process of claim 14 or 30, wherein (51) the primary product *maintains* a bulk density in a range of from 0.1 to 1.8 g/cm³ (see column 4, lines 57-61; * column 5, lines 36-44*); wherein (52) the primary product *maintains* a bulk density in a range of from 0.3 to 1.5 g/cm³ (see column 4, lines 57-61; *column 5, lines 36-44*); and wherein (53) the primary product *maintains* a bulk density in a range of from 0.5 to 1.3 g/cm³ (see column 4, lines 57-61; *column 5, lines 36-44*).

Rather, Woods discloses, “For example, a graphite sheet with a graphite density of about 0.08 to about 0.5 g/cc may be mechanically deformed resulting in a compressed sheet or plate with a graphite density greater than 1.0 g/cc,” (column 5, lines 36-44). Woods does not provide any examples satisfying this limitation; however, the claimed ranges overlap the open-ended range set forth in Woods.

In light of this, it has been found that in the case where claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists – *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

Art Unit: 1712

Therefore, the maintained density ranges of claims 19-21 would have been obvious because the initial range of Woods, 0.08 to about 0.5 g/cc, falls within the claimed range, and the final range of Woods, greater than 1.0 g/cc, overlaps the claimed range.

Regarding claim 44, Woods discloses the synthetic resin-impregnated body according to claim 1 or 10, wherein (44) it includes at least two independently held together networks, one of said networks being formed of a connected framework made of expanded or expanded and thereafter at least partially recompressed graphite with electrical and thermal conductivity, and the other of said networks being a connected network made of synthetic material having penetrated into said pore system (column 4, line 50 through column 5, line 5; column 5, lines 20-35); however, he does not explicitly disclose an electrical volume resistance from 0.10 to 0.77 mΩ.

Due to the conductive nature of the graphite materials, it appears that this volume resistance would have been an inherent property of Woods' invention. The resin-impregnated body of Woods contains the same materials as the instant invention.

In light of this, it has been found that, "Products of identical chemical composition can not have mutually exclusive properties." A chemical composition and its properties are inseparable. Therefore if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present – *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

Therefore the product of Woods would have inherently had a volume resistance of from 0.10 to 0.77 mΩ because the materials used are the same as those used in the instant invention.

Art Unit: 1712

Regarding claim 45, Woods discloses the synthetic resin-impregnated body according claim 1 or 10, (45) including a surface, regions close to said surface, and a remaining part (column 6, lines 12-22 and 50-59); however, he does not explicitly disclose that the resin system is disposed only in one of said remaining part and said regions.

The impregnation method of the instant invention is indistinguishable from the impregnation method used by Woods. In addition, Wood provides an optional step of removing excess resin (column 6, lines 50-59), which would have inherently removed resin from the surface and those areas *close to the surface*.

Therefore, the limitation of claims 12 and 45 would have been inherently satisfied by Woods because his impregnation step is accompanied by the removal of excess liquid, which inherently removes resin from the surface and those areas close to the surface.

5. Claims 1-16, 18-29, 48, 63, and 65 are rejected under 35 U.S.C. 103(a) as being unpatentable over Woods (US Pat. No. 6,656,580 or WO 01/43964), Technical Data Sheets for Resinol 90C and Resinol RTC, (*provided by Loctite*), and Shane et al. (US Pat. No. 3,404,061).

In the following rejection, the technical data sheets have been used to show inherent characteristics of the acrylic resin used in Woods. In addition, since the Woods references are equivalents, all citations are directed towards the US patent.

Regarding claims 1-6, 10, 13, 48, 63 and 65, Woods (*with support of the Technical Data Sheets*) discloses, (1) a synthetic resin-impregnated body (column 4, lines 40-47) comprising a primary product formed of expanded or at least partially recompressed expanded graphite having a liquid-accessible pore system (column 4, line 50 through column 5, line 5), wherein said

Art Unit: 1712

primary product is impregnated (column 5, lines 20-35) with at least one of: at least one solvent-free polymerizable acrylic resin system; and polymers obtained by curing said at least one resin system (column 5, lines 5-10; Technical Data Sheets for Resinol 90C and Resinol RTC);

(2) wherein said at least one acrylic resin system contains triethyleneglycol dimethacrylate (column 9, lines 45-56) and at least one initiator system (column 10, lines 13-27);

(3) wherein said at least one acrylic resin system contains azo initiators as said at least one initiator (column 10, lines 49-67); (4) wherein said azo initiators contained in at least one acrylic resins systems are selected from the group consisting of 2,2'-dimethyl-2,2'-asodipropiononitrile, 1,1'-azobis(1-cyclohexanecarbonitrile) and azoisobutyric acid nitrile (column 10, lines 49-67);

(5) wherein said at least one acrylic resin system has a storage stability at room temperature of more than two days (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(6) herein said at least one acrylic resin system has a storage stability at room temperature of more than two weeks (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(13) wherein a continuous resin surface film is not present and the body is electrically conductive (column 6, lines 50-59; column 4, lines 11-16);

(48) a heat conducting element comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50);

(63) a sealing element comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50); and

(65) a fuel cell component comprising the resin impregnated body of claim 1 or 10 (column 7, lines 14-32; column 8, lines 22-50).

Art Unit: 1712

Regarding claims 14-16, 18, and 22-24. Woods (with support of the Technical Data Sheet s) discloses (14 & 18) a process for producing a resin-impregnated body (column 5, lines 20-36), which comprises: providing a primary product formed of expanded or at least partially recompressed expanded graphite having a liquid-accessible pore system (column 4, line 50 through column 5, line 5); impregnating the primary product with at least one solvent-free polymerizable acrylic resin system to form a resin-containing, uncured intermediate product (column 5, lines 5-10; Technical Data Sheets for Resinol 90C and Resinol RTC); and finally subjecting the intermediate product to a curing treatment (column 10, lines 36-49);

(15) which further comprises processing the resin-containing, uncured intermediate product to form a shaped body (column 5, lines 30-36); and carrying out the subjecting step by subjecting the uncured shaped body produced from the uncured intermediate product to a curing treatment for the at least one resin system (column 10, lines 36-49); (16) which further comprises simultaneously shaping the acrylic resin-containing body (column 5, lines 30-55) and curing the resin system that is present as a result of temperature impact (column 10, lines 36-49);

(22) wherein the acrylic resin has a viscosity at room temperature of less than 100 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C);

(23) wherein the acrylic resin has a viscosity at room temperature of less than 50 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C); and

(24) wherein the acrylic resin has a viscosity at room temperature of less than 20 mPa*s (column 5, lines 5-10; Technical Data Sheets for Resinol 90C).

With respect to all of the above mentioned claims, Woods uses his impregnated flexible graphite sheet (*from compressed, exfoliated graphite particles*) to form sealed fluid-flow field

Art Unit: 1712

plates in a fuel cell (*see 222A and 222C of Figure 3*). These impregnated flexible graphite plates are very similar to impregnated bodies of the instant invention; however, Woods is deficient because he fails to disclose the following limitations:

- *(1 & 14)* wherein the primary product has an ash value limited to not more than four percent of the primary product; and
 - *(18)* wherein the primary product has an ash value limited to not more than two percent of the primary product.

With respect to the ash value limitation, Shane et al. disclose a method of making flexible graphite materials that are analogous to those used in Woods, wherein these sheets can be further impregnated with resin (*see column 4, line 42 through column 5, line 6*). Shane et al. disclose that ash content is a measurement of purity, and their flexible graphite sheets demonstrate a high level of purity (*column 13, lines 7-10; column 7, line 25-31*). This high level of purity is exemplified by an ash content of less than 1 percent (*see column 7, lines 25-31*). Such a level of purity appears to contribute to the level of flexibility, strength, and orientation (anisotropy) that makes these flexible graphite sheets unique and advantageous to the skilled artisan (*column 4, lines 43-59*).

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to limit the ash value to less than four and two percent, as taught by Shane et al., in the flexible graphite sheets (*fluid-flow field plates*) of Woods because Shane et al. disclose that this high level of purity (*low ash content*) contributes to the level of flexibility, strength, and orientation (anisotropy) that makes these flexible graphite sheets unique and advantageous to the skilled artisan for multiple end uses, including impregnation.

** In the above rejections, the impregnated carbon body would have been inherently thermally and electrically conductive due to the inherent conductive nature of the graphite material. In addition, the acrylic resins would have been inherently “solvent-free” because the Technical Data Sheets provide no detail regarding a solvent presence or content.*

Regarding claims 7-9 and 25-27, Woods is silent regarding providing specific “take-up” values of (7 & 25) up to 100% (up to 50 wt% acrylic), (8 & 26) 5-35% (5 to 25 wt% acrylic), and (9 & 27) 10-25% (10 to 20 wt% acrylic). However, he discloses, “the amount of sealant up-take can be controlled over a wide range by varying the impregnation pressure, temperature, sealant viscosity, impregnation time of density of the sheet,” (column 6, lines 33-36). Applicant fails to show criticality for this range, and this range is a result effective because it has a direct impact on the process-ability and shaping capability of the impregnated sheet. In light of Woods’ teaching, it would have been obvious to one skilled in the art to tailor the “up-take” value by choosing the appropriate processing and material parameters.

Furthermore, it has been found that, “where general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation,” –*In re Boesch*, 617 F.2d 272, 205 USPQ 215 (CCPA 1980).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide the specific “take-up” values of up to 100% (up to 50 wt% acrylic), 5-35% (5 to 25 wt% acrylic), and 10-25% (10 to 20 wt% acrylic) in the impregnated body of Woods

Art Unit: 1712

because Woods discloses that the “take up” can be tailored by numerous process and material parameters, resulting in desirable process-ability and shaping capability of the impregnated body.

Regarding claims 28 and 29, Woods fails to explicitly disclose the curing conditions set forth in claims (28 & 29). However, Applicant fails to show criticality for these curing conditions, and these conditions are result effective variables, necessary to achieve a successful curing reaction.

Therefore, it would have been obvious to one of ordinary skill in the art at the time of the invention to use the curing conditions of less than 10 minutes or less than 3 minutes at a temperature of up to 200°C in order to achieve an optimized and successful curing reaction of the impregnated resin.

Regarding claims 19-21, Woods does not explicitly disclose the process of claim 14 or 30, wherein (19) the primary product *maintains* a bulk density in a range of from 0.1 to 1.8 g/cm³ (see column 4, lines 57-61; * column 5, lines 36-44*); wherein (20) the primary product *maintains* a bulk density in a range of from 0.3 to 1.5 g/cm³ (see column 4, lines 57-61; *column 5, lines 36-44*); and wherein (21) the primary product *maintains* a bulk density in a range of from 0.5 to 1.3 g/cm³ (see column 4, lines 57-61; *column 5, lines 36-44*).

Rather, Woods discloses, “For example, a graphite sheet with a graphite density of about 0.08 to about 0.5 g/cc may be mechanically deformed resulting in a compressed sheet or plate with a graphite density greater than 1.0 g/cc,” (column 5, lines 36-44). Woods does not provide any examples satisfying this limitation; however, the claimed ranges overlap the open-ended range set forth in Woods.

Art Unit: 1712

In light of this, it has been found that in the case where claimed ranges “overlap or lie inside ranges disclosed by the prior art” a *prima facie* case of obviousness exists – *In re Wertheim*, 541 F.2d 257, 191 USPQ 90 (CCPA 1976).

Therefore, the maintained density ranges of claims 19-21 would have been obvious because the initial range of Woods, 0.08 to about 0.5 g/cc, falls within the claimed range, and the final range of Woods, greater than 1.0 g/cc, overlaps the claimed range.

Regarding claim 11, Woods discloses the synthetic resin-impregnated body according to claim 1 or 10, wherein (11) it includes at least two independently held together networks, one of said networks being formed of a connected framework made of expanded or expanded and thereafter at least partially recompressed graphite with electrical and thermal conductivity, and the other of said networks being a connected network made of synthetic material having penetrated into said pore system (column 4, line 50 through column 5, line 5; column 5, lines 20-35); however, he does not explicitly disclose an electrical volume resistance from 0.10 to 0.77 mΩ.

Due to the conductive nature of the graphite materials, it appears that this volume resistance would have been an inherent property of Woods’ invention. The resin-impregnated body of Woods contains the same materials as the instant invention.

In light of this, it has been found that, “Products of identical chemical composition can not have mutually exclusive properties.” A chemical composition and its properties are inseparable. Therefore if the prior art teaches the identical chemical structure, the properties applicant discloses and/or claims are necessarily present – *In re Spada*, 911 F.2d 705, 709, 15 USPQ2d 1655, 1658 (Fed. Cir. 1990).

Art Unit: 1712

Therefore the product of Woods would have inherently had a volume resistance of from 0.10 to 0.77 m Ω because the materials used are the same as those used in the instant invention.

Regarding claim 12, Woods discloses the synthetic resin-impregnated body according claim 1 or 10, (12) including a surface, regions close to said surface, and a remaining part (column 6, lines 12-22 and 50-59); however, he does not explicitly disclose that the resin system is disposed only in one of said remaining part and said regions.

The impregnation method of the instant invention is indistinguishable from the impregnation method used by Woods. In addition, Wood provides an optional step of removing excess resin (column 6, lines 50-59), which would have inherently removed resin from the surface and those areas *close to the surface*.

Therefore, the limitation of claims 12 and 45 would have been inherently satisfied by Woods because his impregnation step is accompanied by the removal of excess liquid, which inherently removes resin from the surface and those areas close to the surface.


Art Unit: 1712

Communication

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Michael J. Feely whose telephone number is 571-272-1086. The examiner can normally be reached on M-F 8:30 to 5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Randy Gulakowski can be reached on 571-272-1302. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Michael J. Feely
Primary Examiner
Art Unit 1712

December 22, 2005

MICHAEL FEELY
PRIMARY EXAMINER